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ABSTRACT

One hundred seventeen administrators, users of both batch process and online computer systems at a major university, responded to a questionnaire designed to discover attitudes toward the quality of the system and services, the users' evaluation of the service, and the relationship of these attitudes with voluntary use of the system. These attitude, evaluation, and use factors were considered in relation to the actual quality of the system as rated independently by the information services department staff. Data were collected on input-output quality; adequacy of training; management support; quality and kinds of reports generated; input error ratings; usefulness; accuracy; timeliness, flexibility; completeness; and pressure to reprogram the system. Step-wise multiple regression was used to analyze the data, which did show an association between actual quality of systems, and quality as perceived by users, with favorable user attitude. These favorable attitudes and evaluations were also positively associated with system usage. Further, increased voluntary use may be predicted by favorable attitudes, which provides good reasons for information services to develop high quality systems and favorable user attitudes. (LS)

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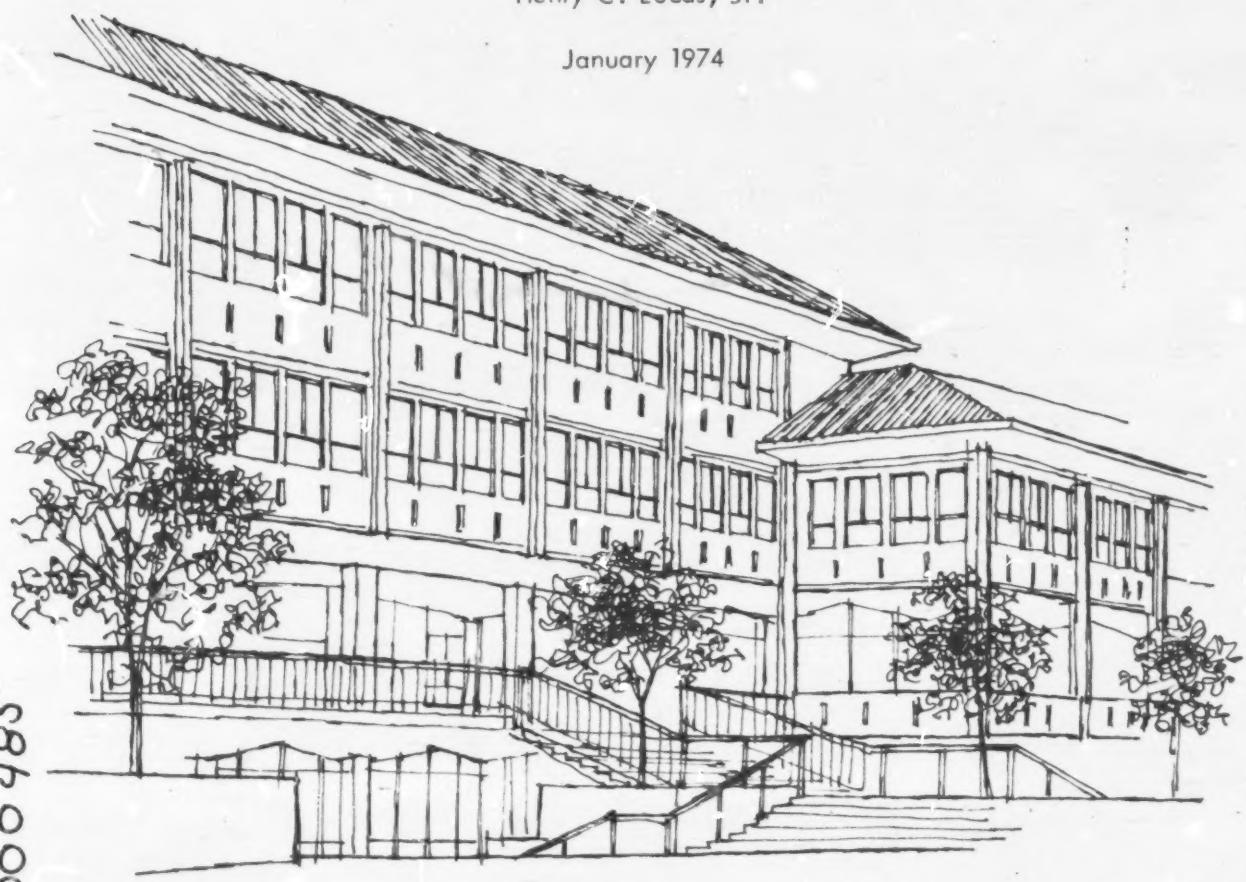

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SYSTEMS QUALITY, USER REACTIONS AND THE USE OF INFORMATION SYSTEMS

Henry C. Lucas, Jr.*

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SYSTEMS QUALITY, USER REACTION AND THE USE OF INFORMATION SYSTEMS

INTRODUCTION

In two past studies the quality of computer systems as perceived by users was found to be strongly associated with favorable user attitudes toward the information services department staff and with ratings of computer potential [4,5]. In these studies, perceptions of systems quality and user reactions were all measured by the same data source, a user questionnaire. Is this association between attitudes and systems quality due to a "halo effect" from the questionnaire or do other independent measures of system quality have a positive association with user attitudes? Another question of interest is whether the use of an information system can be predicted by favorable user attitudes (usage measures were not included in the earlier studies [4,5]).

The purpose of this paper is to present the results of a study of user reactions, the use of information systems and an independent rating of systems quality. The paper also describes the factors associated with the use of an online system which has encountered a number of problems. Specifically, the research was formulated to test the following hypotheses:

Hypothesis 1: Favorable user attitudes are associated with favorable user perceptions of systems quality and independent ratings of systems quality.

Hypothesis 2: The use of an information system is positively associated with favorable user attitudes, favorable user perceptions of systems and favorable independent ratings of systems quality.

Issues related to quality of service are a major cause of the interaction between users and the information services department staff. If this interaction is favorable it should result in the formation of positive attitudes.

If the interaction occurs under adverse circumstance, poor attitudes may be the result. Users are expected to have fairly accurate perceptions of the quality of service even allowing for perceptual distortions created by unrepresentative incidents or problems. That is, user evaluation of systems should be consistent with independent ratings of the quality of information systems [4,6].

For almost all information systems, some use of the system is required for example, it may be the only way to process orders or to compute the payroll. However, it is expected that the use of systems beyond basic input and transactions processing is voluntary. For example, a user generally decides voluntarily to perform an extensive analysis of an output report instead of just glancing at it. Attitudes have an action component and favorable attitudes are consistent with high levels of voluntary use of information systems [4,6]. On the other hand, in the case of forced use of a poor quality system, user experiences may actually lead to unfavorable attitudes.

THE STUDY

Background

The data in this study were collected in a major university· the sample included administrative users of 26 separately identifiable batch computer systems. These systems are concerned with accounting, student record keeping, purchasing, fund raising, alumni record keeping, etc. The administrative computer staff has also developed an online system for university processing and several applications had been converted to this system at the time of this study. Users are able

to process certain employee data and student records online. The online system features special purpose programs along with a general inquiry facility. It is felt that the nature of the batch and online applications and the tasks of the university administration create an environment for information systems which is comparable to other private and public sector organizations.

Research Design

User attitudes toward information services department activities and perceptions of the quality of information systems service were measured by a questionnaire which was returned by 117 users on the university administrative staff. (Allowing for terminations and questionnaires sent to non-users, the number of questionnaires returned was almost 70% of those distributed.) This questionnaire is similar in structure to those used in past studies, the majority of responses have a range from one to seven [4].[1]

An independent measure of service quality is difficult to obtain. A panel of experts could be employed to rate existing systems; however, it is difficult to convene such a panel and an extensive effort would be required to perform the evaluation. To obtain a rating of systems quality independently from user perceptions in this study a structured questionnaire was administered to information services department staff members in operations and systems design positions. This questionnaire dealt with the quality of systems as seen by users; there were no questions on the technical elegance, programming aspects or file structures of the systems.

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[1] The questionnaire developed for this and prior studies included a number of variables suggested by previous research; see [1,2,4].

Between one and three staff members in the information services department completed a questionnaire on each of the 26 systems and an attempt was made to have a minimum of two people rate each system. These responses were averaged to develop a single rating for each system which can vary from one to seven.

Factor analytic and correlation techniques were used on both the user and the information services department questionnaire to form scales by averaging different items on the questionnaire which were highly related. The scales on the user questionnaire are very similar to those of an earlier study [4]. User respondents were asked to circle each of the 26 systems which they used on the questionnaire. To develop a single rating of the systems by the information services department staff for each respondent, the information services department ratings for each of the systems a user reported using were averaged together. Thus, the independent ratings of service quality represent averages of the information systems department system evaluations for all the systems with which a user reported having contact.

VARIABLES

The variables in the study are shown in Table 1. The variables labeled "ISD Ratings" were derived from the process described above from the questionnaire administered to the information services staff. All other variables were developed from the user questionnaire . In general, all variables are coded so that a higher numeric response is more favorable.

User Attitudes	A_1	Computer Potential
	A_2	Attitudes Toward ISD Staff [1]
User Perceptions	P_1	Input Quality
	P_2	Output Quality
	P_3	Rating of Online system
	P_4	Training
	P_5	Contact with ISD
	P_6	Management Support
	P_7	Suitability of numbers of reports received
	P_8	Would like more summary and exception reports
	P_9	Involvement
ISD Ratings	R_1	Input Quality
	R_2	Output Quality
	R_3	Overall Quality
	R_4	Integration and Changes requested
	R_5	System Usefulness
	R_6	Documentation, Training, Accuracy
	R_7	Online Performance
Situational	S_1	Position
	S_2	Time on job

TABLE 1

Variables in the Study

[1] Information Services Department

Personal	I_1	Education
	I_2	Age
Use of System	U_1	Batch system amount of use
	U_2	Batch use for various activities/decisions
	U_3	Online system use of specific features
	U_4	Online system use in general

TABLE 1 (continued)

Variables in the Study

User Reactions

User reactions to information systems were measured by two attitudinal variables in the study; computer potential and attitudes toward the information services staff. The computer potential scale consists of two questions in which the respondent rated the clerical and managerial potential of computers for administrative use. Attitudes toward the information services department staff include several items from the questionnaire describing staff competence, interest in the user, appreciation for the user's problems, etc.

User Perceptions

A number of user perceptions of information services activities were included in this study. Ratings of input and output quality were developed from items on the questionnaire describing the timeliness and accuracy of input and output along with the general usefulness of output. Ratings of the online system include an evaluation of its response time, reliability and ease of use.

The training scale includes items describing the amount of training reported by the user and perceptions of the adequacy of the training in preparing for the use of a new system. Contact with the information services department was measured by an item on which the respondent indicated the amount of time spent on information systems-related activities during the prior week. Perceived management support is a single item on the questionnaire reflecting the user's perception of the extent to which management supports more administrative computer use within the university.

A high response to the scale on the suitability of the number reports received indicates that the user is satisfied with the present reports he

receives or would like to receive even more reports from the computer. On the other hand a high score on the desire for summary and exception reports means that the user would like to receive more of this type of report while a low score indicates that he is relatively satisfied with the present form of reports.

Information Services Ratings

Seven scales evaluating the quality of information systems were developed from the questionnaire completed by the information services department staff. Input and output quality is based upon the clarity of input/output documents, input error ratings, and the usefulness, accuracy and timeliness of output reports. The overall quality of systems scale consists of ratings of systems flexibility, the lack of pressure to reprogram the system, and the completeness of the functions contained in the system.

An analysis of the questionnaire indicated that a question on the integration of systems and a lack of change request should be combined into a single rating scale (Variable R_4). Systems usefulness consists of a rating of how much the system can be used for decision making, trend analysis, planning, taking action and problem finding. Documentation, training, and systems accuracy also were found to form a single scale (Variable R_6). Finally, for online systems the rating scale consists of items reflecting the response time and stability of the online system.

Situational and Personal Factors

Several situational and personal variables were developed from the user questionnaire. Position refers to the level of the respondent in the

organization and ranges from clerical worker to top management. Time on the job represents the length of time that the respondent has been in his present position. Age and education were also obtained from the questionnaire.

Use of Systems

For batch systems, two scales were derived from the user questionnaire for the amount of use of information systems. The first variable (U_1) deals with the general use of systems. The second variable (U_2) is concerned with the use of the systems for specific functions like decision making, trend analysis, etc.

Two usage scales were also developed for online systems from the questionnaire. The first of these (U_3) is concerned with the frequency of use of the online system, and the use of specific functions like the inquiry language. The second usage scale (U_4) represents use of the online system for different activities like decision making, trend analysis, etc.

RESULTS

Because of the multivariate nature of the hypotheses, step-wise multiple regression was used to analyze the data. The step-wise regression algorithm was terminated when the coefficient of an incoming variable would be insignificant at the .10 level.[2]

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[2] A few of the coefficients are not significant at the .10 level due to changes in the equations which occured when subsequent variables entered; each variable was significant at the .10 level or better when it entered the equation.

Systems Quality and User Reactions

The first hypothesis is that user reactions are positively associated with user perceptions of systems quality and independent ratings of systems quality. The results for computer potential are shown in Equation (1) and

$$(1)\quad A_1 = 1.59 + .24\ P_4 + .40\ P_5 + .12\ P_6 + .49\ P_7 + .19\ R_2 + .05\ S_1$$
$$\qquad\qquad (1.96)\quad (2.32)\quad (1.29)\quad (1.99)\quad (1.80)\quad (1.68)$$

attitudes toward the information services staff in Equation (2).[3] These

$$(2)\quad A_2 = -1.05 + .31\ P_2 + .18\ P_6 + .42\ R_1 + .21\ R_3$$
$$\qquad\qquad (2.97)\quad (.18)\quad (1.68)\quad (1.38)$$

two equations provide strong support for the first hypothesis. Perceptions of training, contact with the information services department and the suitability of the number of reports received are positive predictors of ratings of computer potential. Output quality rated by the information services department staff independently of users is also a positive predictor of user ratings of computer potential.

Attitudes toward the information services staff are positively associated with perceived output quality and management support in Equation (2). Independent information services department ratings of input quality and overall systems quality are also positive predictors of user attitudes toward the information services department staff. Thus, hypothesis 1 receives substantial support from the results in Equations (1) and (2).

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[3] The number in parentheses below each coefficient in the equations represent t values. (Table 2 contains information on the statistical attributes of each equation.)

Equation	n	R	R^2	F	P
1	80	.51	.26	4.34	.001
2	77	.54	.29	7.47	.001
3	80	.56	.32	5.65	.001
4	79	.43	.19	3.75	.01
5	37	.86	.74	17.44	.001
6	36	.82	.67	8.06	.001

TABLE 2

Attributes of Equations

Use of Systems

The second hypothesis is that favorable user attitudes and perceptions are associated with voluntary use of information systems. For the most part the use of the output batch systems is voluntary, though the provision of input is required. The majority of users, however, receive output reports from these systems as their major benefit. The results for batch use shown in Equations (3) and (4) generally support Hypothesis 2.

$$(3)\quad U_1 = 4.80 + .21 A_1 + .45 P_7 - .20 P_8 - .46 R_1 + .50 R_5 - .18 I_1$$
$$\qquad\qquad\qquad\quad (1.82)\quad (1.78)\quad (1.56)\quad (1.88)\quad (2.78)\quad (2.51)$$

$$(4)\quad U_2 = 1.07 + .49 P_7 + .56 R_3 + .10 S_1$$
$$\qquad\qquad\quad (1.34)\quad (2.58)\quad (2.17)$$

Computer potential is a positive predictor of use in Equation (1) as is the suitability of the number of reports received. The negative sign for the variable P_8 can also be interpreted as favorable since this means that the user is satisfied with the format of present reports and does not feel the need for more summary or exception reports. The independent information services department rating of systems usefulness is positively associated with use; only the independent rating of input quality is negatively related to higher usage in Equation (3). Given the fact that input is the least voluntary aspect of the use of an information system, this finding is not surprising. In Equation (4) the suitability of the number of reports received and ratings of overall systems quality are positively associated with systems use.

A PROBLEM ONLINE SYSTEM

System Status

The major online system operated by the information services department had been under development for several years and was not completely implemented at the time of the study. There had been a number of problems with machine failures and the majority of the users represented clerical personnel who had to use the system to enter data; the old alternative of batch processing was no longer available. The system is not strictly online since some batch reports are produced from the data collected online.

As shown in Table 3 the perceptions of users of the online system are much less favorable than for users of the batch system. (It should be noted that these ratings also include any batch systems used by the respondent). Input/output quality is rated significantly lower for all systems by users of the online system. This finding represents a contrast to a past study in which online systems were associated with more favorable ratings of input and output [4]. More information services department contact and involvement are reported by users of the online system, probably because of the system's recent development. However, less management support is perceived by these users. The only favorable response is the variable which represents greater satisfaction with the current number of reports received or the desire for more reports by users of the online system. At the same time these users also express the desire for more summary and exception reporting.

It is interesting to note that the ratings by the information services department staff also favor groups using batch systems exclusively.

Variable	Means Batch (n=85)	Online (n=41)	t Value	P ≤
P_1	5.13	4.44	3.29	.001
P_2	5.05	4.44	2.50	.02
P_5	1.42	1.66	-1.86	.07
P_6	5.59	4.73	3.92	.004
P_7	2.12	2.46	-3.72	.001
P_8	2.33	2.76	-2.17	.03
P_9	1.97	2.96	-4.53	.001
R_2	5.53	4.97	6.06	.001
R_3	4.09	3.81	1.97	.05
R_4	4.39	5.24	-3.30	.002
R_5	4.84	4.41	3.77	.001
R_6	4.55	3.90	4.91	.001
S_2	5.42	2.41	5.30	.001
I_1	3.92	5.23	-3.90	.001
I_2	43.48	34.50	4.12	.001

TABLE 3

Online vs. Batch System Users

Output quality and overall quality are rated higher for exclusively batch users. The general uses for the system and documentation and accuracy ratings follow the same pattern. The information services department staff ratings for the group using the online system is more favorable than exclusively batch system users for the amount of system integration and the changes needed.

Personal characteristics also differ significantly among the respondents who use only batch systems and those who also use the online system. Use of the online system is associated with less time on the job and with younger and more educated employees. Such a group may be the hardest to satisfy with a computer system as they may expect more and be more impatient with problems. The relatively poor ratings of the online system are probably due both to these characteristics and the problems encountered in evaluating a recently designed and implemented system. The online system is compared with batch systems which, in general, have been in smooth operation for a much longer period.

Use of the Online System

Given these problems with the online system, are there significant differences in the factors which are associated with the use of the system? The results in Equations (5) and (6) indicate that even for the relatively poorly rated online system, use is positively associated with user perception of systems quality and information services ratings of systems

$$(5)\quad U_3 = -.70 - .36\,A_2 + .88\,P_3 + 1.25\,R_3 - 1.70\,R_6 + 1.24\,R_7$$
$$\qquad\qquad\qquad\quad (2.37)\quad (6.71)\quad (4.52)\quad (5.54)\quad (2.03)$$

$$(6)\quad U_4 = -5.42 + .52\,A_1 - .70\,A_2 + .85\,P_3 - 2.40\,R_2 + 1.04\,R_3 + 1.48\,R_5 + 1.80\,R_7$$
$$\qquad\qquad\qquad\quad (2.87)\quad (3.68)\quad (4.98)\quad (3.99)\quad (3.20)\quad (2.96)\quad (2.05)$$

performance. Use of the system is also positively related to information services department ratings of overall quality and systems usefulness. However, use of the system is negatively related to information services department ratings of output quality and documentation, training, and accuracy. For general use in Equation (6) ratings of computer potential by users is a positive predictor of use. However in both Equations (5) and (6), attitudes toward the information services staff are negatively associated with use. This result is contrary to the general findings for batch users in Equations (3) and (4), though understandable given the unfavorable ratings of the system and its implementation problems. Users of the online system have had high levels of contact with the information services department staff under the difficult circumstances surrounding conversion and implementation so unfavorable staff ratings might be expected.

Extensions

The research techniques and instruments in this study can be used by any organization to evaluate its information systems. This study has demonstrated an association between systems quality and user reactions to information systems. The survey instruments could easily be administered and analyzed to provide management with information on user reaction to specific systems in an organization. Both the systematic statistical results and the suggestions from open-ended sections of the questionnaire can be extremely valuable to management. For example the sample can be partitioned by systems and applications which differ from the mean rating for all systems can be examined to locate particular problems. If a data

base of similar studies becomes available through this and other research, norms could be developed for different systems and different types of industries with which an organization could compare its own systems evaluation results.

DISCUSSION

The two hypotheses received substantial support from this study. The quality of systems rated independently and as perceived by users is associated with favorable user attitudes. Favorable attitudes and ratings of systems quality are also associated with the use of systems. However, these results have not demonstrated causality due to the cross-sectional nature of the research. It does seem reasonable, given the independent evaluation of systems quality, that quality influences attitudes. It is hard to believe that user attitudes could lead directly to better systems quality as rated independently by the information services department. However, the direction of any possible relationship between attitudes and the use of the system is not completely clear. Voluntary use is expected to be predicted by favorable attitudes. On the other hand, if use of a system is mandatory, the use of a poor quality system could lead to the development of unfavorable user attitudes.

From a practical standpoint, the quality of systems is more under the control of the information services department staff than are user attitudes. The findings of this study suggest that before undertaking new systems, the quality of existing systems as rated by users should be satisfactory. It may be necessary to enhance or redesign existing systems before undertaking the development of new ones. A user's past experience is his

best predictor of the benefits of a new system, and successfully functioning systems are a prerequisite to obtaining user cooperation in systems design.

During the development of any system, the information services department staff should consider user attitudes and perceptions and should try to measure the quality of systems from the user's standpoint. For an example of a systems design activity including conscious consideration of user reactions, see [3].

Finally, if the information services department and management have faith that information systems are worthwhile and contribute to the organization, then they should try to encourage high levels of systems use. Though causality has not been demonstrated, a priori arguments and the data support the goals of developing favorable user attitudes and high quality systems to encourage the use of information systems.

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